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IDA MEMORANDUM REPORT M-467

REPORT ON THE FY 1987 ACTIVITIES OF THE  
DEFENSE SCIENCE STUDY GROUP

VOLUME I

Nancy P. Licato

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May 1988

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I am most grateful to Admiral C.A.H. Trost, Chief of Naval Operations, for providing CDR John Allison, USN. CDR Allison was invaluable in setting up the tours of Naval facilities, assisting IDA with overall arrangements and providing insight into Naval operations. As the U.S. Navy representative on the tour, he proved to be a ready source of information on all aspects of the Navy and put into context much of what was seen.

I am particularly grateful to: Ms. Nancy P. Licato, who has the overall administrative responsibility for this program, in addition to organizing the technical sessions and arranging the field trips; to Mr. Richard J. Bergemann, who I rely on for innovative ideas, planning and development, for organizing some technical sessions and for contributing to the preparation of this report; to Dr. Maile E. Smith, who assists in the planning and development and the introduction of new ideas; to Dr. Francis X. Hartmann, who assisted the DSSG members in arranging some of their technical sessions.

I want to thank the mentors for providing continuing guidance and support to the participants, to my staff and to myself.

My special thanks to the participants, who, by their enthusiastic response to each new experience, by taking active participation in planning future sessions, and by becoming involved in programs for the Federal Government, are proving the worth of this program.

Robert E. Roberts  
Program Director

## ABSTRACT

The principal objective of the Defense Science Study Group (DSSG) is to reestablish and strengthen links between the Department of Defense and the scientific and engineering communities by fostering an interest among some of the country's most promising young scientists in some of the most important technical issues related to national security.

Volume I of this report on the FY 1987 activities of the DSSG contains a description of the DSSG program and a summary of its second year of activity. Volume II contains a summary of preliminary presentations given at the final Review Session.

# CONTENTS

## VOLUME I

Acknowledgments .....	iii
Abstract .....	v
I. INTRODUCTION .....	1
A. Objective .....	1
B. Approach .....	2
II. DEFENSE SCIENCE STUDY GROUP PROGRAM FOR FY 1987 .....	5
A. Activities .....	5
1. Spring Technical Meeting .....	6
2. Summer Tour of Naval Operations .....	7
3. Fall Working Session .....	8
4. Winter Review Session .....	10
B. Assessment .....	13
C. Future Plans .....	13
APPENDIX A--Members and Mentors .....	A-1
APPENDIX B--Meeting Agendas .....	B-1
APPENDIX C--Meeting Minutes by Members .....	C-1
APPENDIX D--List of Session Coordinators and Committee Members .....	D-1
APPENDIX E--Task Statement .....	E-1
APPENDIX F--Program Administration .....	F-1

## VOLUME II

### SUMMARY OF PRESENTATIONS BY MEMBERS AT REVIEW SESSIONS

Abstract .....	iii
DSSG Study Program: Long-Range Effects .....	1
Overview of FY 1987 Program .....	7
Monitoring Yields of Underground Nuclear Tests .....	29
High Temperature Superconductors .....	35
Blue-Green Lasers and Communications with Submarines .....	37

## I. INTRODUCTION\*

Today's complex technical issues associated with national defense require the attention of the best scientists and engineers in the country. From World War II until the Viet Nam War, a close link existed between the elite of the scientific community and the defense establishment. This link not only helped ensure that the nation's defense needs were met, but also provided knowledgeable technical criticism of the highest quality. This link was weakened substantially during the Viet Nam War, thus depriving the defense establishment of access to many of the country's most talented researchers for both contributions and informed criticism.

A long-standing strength of the Institute for Defense Analyses (IDA) has been its ability to provide an atmosphere in which the scientific community could become aware of the specific technical content of national security issues and in which scientists could carry out academic research on defense-related technical problems. Recognizing this, in FY 1986 the Defense Advanced Research Projects Agency (DARPA) established the Defense Science Study Group (DSSG) at IDA to identify a select group of young scientists and engineers in the country outside the defense community and expose them to the major technical problems of national defense.

### A. OBJECTIVE

The principal objective of the DSSG is to reestablish and strengthen links between the Department of Defense and the scientific and engineering communities by fostering an interest among some of the country's brightest young scientists in the technical aspects of national defense issues. This is accomplished in a program that combines education on a broad range of defense topics with independent research on technical defense problems of interest. Program participants acquire an understanding of the difficulty and importance of national defense issues and an appreciation for the technical competence of the defense

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community. It is hoped that participants will provide new insights on defense problems as a result of their research activities, guide some of the most promising students of today into defense careers, and play an active role in the defense community in the future. The program seeks to foster a more complete understanding of the broader issues associated with the defense of this country among those individuals who are likely to be among the most influential and respected members of the scientific and engineering community of tomorrow.

## **B. APPROACH**

The DSSG is academically based primarily and is characterized by its multidisciplinary nature and the rigorous and careful process that is followed to select participants. The names of candidates can be suggested by participants and mentors or solicited from organizations such as the National Science Foundation, the Office of Science and Technology Policy, and the Sloan Foundation. Nominations are also taken from outstanding individuals in any field of science or technology. The selection of candidates invited to join is made by IDA after consulting with a variety of senior individuals for references and after the candidate has been approached to establish interest in the program. The maximum length of time that participants can remain in the program is three years. A list of the 17 individuals who were members of the DSSG in FY 1987 can be found in Appendix A.

A group of senior mentors who have had distinguished careers in defense or academia serve as advisors. They help identify candidates, suggest defense problems of importance to study, advise IDA on the conduct of the program, independently review the technical work accomplished, and assess the overall success of the program. A list of the mentors of the DSSG in FY 1987 can also be found in Appendix A.

The Institute for Defense Analyses directs and administers the DSSG program and gives it continuity. It selects all participants, organizes the program's agenda, arranges all program activities, and provides the necessary administrative support. In addition, by virtue of its own active defense research and analysis program, it provides a convenient source of in-house expertise on a variety of defense topics. IDA is also responsible for identifying those within the defense community who are most likely to benefit from the work of the DSSG.

DARPA functions as the program sponsor. It provides guidance to the program, assists in developing the program's technical agenda, and is the direct recipient of the results of the DSSG's activities.

DSSG activities are split between education and research. The educational portion of the program is structured around a number of major national security issues. The introduction to these topics includes presentations and seminars by defense experts and organized travel to major defense facilities.

Research activities are conducted by the participants who choose their own topics within very broad guidelines. Participants work alone or organize themselves into groups as they see fit. They are provided access to both classified and unclassified resources through IDA. Participants are encouraged to work on research projects when the DSSG is not formally in session and the IDA facilities and services are available to the participants upon request.

## **II. DEFENSE SCIENCE STUDY GROUP PROGRAM FOR FY 1987**

The principal objectives of the DSSG program during its second year were to continue to (1) introduce the participants to defense-related scientific and technical problems, (2) expose them, via on-site visits, to the actual usage of technology, and (3) stimulate an interest among the group in contributing to the solution of national defense problems.

In order to enhance the disciplinary diversity of the participants and respond to suggestions made by DARPA at the end of the last year of the program, two computer scientists and a biologist were identified and invited to join in early 1987. Thus, the DSSG increased from the original 14 to 17. Because of heavy schedules, two mentors had to drop out of the program. Two new mentors were added. A list of the current participants and mentors is shown in Appendix A.

### **A. ACTIVITIES**

In its second year of operation, the DSSG convened four times as shown in Fig. 1. Appendix B contains the agendas for each DSSG meeting held, and Appendix C contains a set of minutes that was prepared by the participants subsequent to all meetings. The purpose, format, synopsis of activities, and outcome of each meeting are described in more detail in the following sections.

**Figure 1. Schedule for FY 1987**

Spring Technical Meeting	May 8-9, 1987
Summer Tour of Naval Operations	June 21-July 2, 1987
Fall Working Session	September 17-22, 1987
Winter Review Session	December 4-5, 1987

## **1. Spring Technical Meeting**

The purposes of the first meeting in FY 1987 were to introduce the DSSG to (1) U.S. naval operations, technology and capabilities, and (2) the role of the legislature in national defense technology issues.

The briefings on the morning of the first day were designed to provide a technical framework of the U.S. Navy in preparation for a tour through naval facilities, scheduled for the second meeting. These briefings and the tour were organized with the assistance of the Chief of Naval Operations, who assigned CDR John Allison, USN, as the U.S. Navy representative.

The DSSG received briefings on such interrelated topics as an overview of the U.S. Navy, technology in naval operations, the Soviet naval threat, U.S. maritime strategy, naval submarine operations, and research and development in the U.S. Navy. These briefings were given by the Public Affairs Office of the Office of the Assistant Secretary of Defense, and by representatives from the Department of the Navy: Program Planning Office; Undersea and Strategic Warfare and Nuclear Energy Development Division, Office of Research, Development and Acquisition; Operational Intelligence Center; Strategic Concepts Group; Attack Submarine Division; Office of Naval Technology.

The afternoon session focused on designing the program activities for the year and involved IDA and the DSSG participants and mentors. Robert E. Roberts, the program director, gave a half-hour talk on current and tentative plans for the year and for the future. The attendees then broke up into two groups (the participants in one group and the mentors and IDA staff in the other) to summarize amongst themselves their thoughts on current and future activities and plans for the future.

It was felt that an introduction to the Department of Defense would not be complete without an understanding of the role of Congress in the setting of R&D priorities for national defense. The set of briefings in the morning of the second day was organized by one of the mentors, Martha Krebs, and introduced budget and policy issues connected with defense research and development from the viewpoint of Congress, and the Office of Management and Budget and the Office of Science and Technology Policy in the Executive Office of The President. A broad understanding of the activities of the U.S. Navy and the role of Congress and the Executive Office was conveyed from several different points of view.

The afternoon meeting consisted of a summary and wrap-up discussion among all members of the DSSG. The participants concluded that they wished to take a more active role in the design of each session. Katherine Faber and Daniel Stein were chosen as points of contact for the next scheduled session in June.

## **2. Summer Tour of Naval Operations**

The purpose of the 1987 summer session of the DSSG was to see and learn first-hand about U.S. Navy R&D, technology and operations. The 12-day session which began the latter part of June consisted of visits to the various facilities of the U.S. Pacific Command in California, Washington State, and Hawaii. The site visits and briefings were designed so that the DSSG could receive a comprehensive overview of many of the current capabilities and deficiencies of the U.S. Navy.

The group visited the Naval Ocean Systems Center (NOSC) in San Diego on the first day, and received briefings which focused on their activities in non-acoustic ASW, submarine laser communications, Arctic submarine warfare, and microelectronics. The next three days consisted of visits to frigates at sea, an aircraft carrier, a guided missile destroyer, antisubmarine warfare aircraft, the NAS Miramar flight training school and the special warfare amphibious base, all located in the San Diego area.

The group then traveled to the Naval Submarine Base in Bangor, Washington, and was provided a two-day tour of the Strategic Weapons Facility, the Trident Refit Facility, the Trident Training Facility and a Trident submarine, the SSBN USS Ohio.

The next four days were spent visiting the Pacific Command in Hawaii. The group visited NOSC Hawaii to learn about the marine mammal research. Following this, a visit was made to TACAMO at NAS Barbers Point, an antisubmarine squadron which provides continuous airborne communications coverage in support of the Pacific Fleet. The group then received a tour of an attack submarine and its training facility at Submarine Base Pacific. Following this, visits were made to IPAC and Commander Ocean Systems Pacific/Naval Ocean Processing Facility, two intelligence facilities. At CINCPAC, the group received a Pacific Area Update briefing, followed by a briefing in which operational deficiencies were identified. The tour ended at CINCPACFLT with a Command briefing and briefings about current DARPA/CINCPACFLT programs on C<sup>3</sup> Architecture and Battle Management.

Another aspect of the summer program was the setting aside of time every few days for the DSSG to get together to review amongst themselves what they had seen, what technical problems they had encountered that they might be interested in pursuing for future research, and the general conduct and goal of the DSSG in current and future years. This and other aspects of the program for the summer session turned out to be well designed to meet the needs and desires of DSSG participants, in part due to the direct involvement of the participants in program planning.

### 3. Fall Working Session

The purpose of the 6-day working session in September was to focus the DSSG on candidate research topics that might be pursued in the third year of the program. A list of 24 topics of interest to the DSSG was initially chosen when the group was together at the June session. This list can be found in their minutes located in Appendix C. These topics, according to the background and interest of the DSSG, emanated from technical problems suggested by previous sessions, site visits, or areas in which DARPA expressed an interest. From this list, five topics were selected for closer examination at the September meeting. The coordinators for the September meeting were Russel Caflisch and Nathan Lewis. Individual DSSG members arranged half-day programs on selected topics. A list of these topics and the corresponding program organizer can be found in Fig. 2.

Figure 2. Topic Coordinators

High $T_c$ Superconductors	Katherine Faber
Anti-Terrorism	Thomas Rosenbaum
Blue-Green Lasers	R. Stanley Williams
Torpedo Defense	Warren Warren
Space Debris	Frederick Lamb

The topic coordinators, with the assistance of IDA staff and DSSG mentors, located and invited appropriate speakers to brief the group on their subject. The two September meeting coordinators helped to ensure that all elements of the program agenda were developed.

The first day began with the gathering of the DSSG at IDA to organize and make last-minute arrangements for the briefings to come and to get together individually or in groups for work sessions. The first topic briefed was on Surface Ship Torpedo Defense. Speakers from the Naval Sea Systems Command and the Naval Coastal Systems Center presented a look at initial ideas under consideration for the development of a surface ship defense system against submarine-launched torpedoes.

Speakers on the topic of Space Debris were Donald Kessler of the NASA Johnson Space Center and Nicholas Johnson from Teledyne Brown. They focused on the history of space debris and their views of the potential hazards of space debris to manned activities in low earth orbit and to communications satellites, surveillance assets and strategic weapons in either low earth or geosynchronous orbit.

Some members of the DSSG became interested in the subject of submarine laser communications after briefings at NOSC and discussions with SSBN and SSN commanders in Washington State and Pearl Harbor. This exposure gave the DSSG a background in terms of understanding the missions of Navy submarines and the communications problems they currently face. In particular, the DSSG was interested in knowing the merits of the blue-green laser as compared to other methods of submarine communication, whether such a system would have a greater value-added benefit for the SSN or the SSBN fleet, and what the Navy views as the major technological difficulties to be overcome. The speakers to the DSSG on this topic included Thomas Kaye of Naval Ocean Systems Command and CDR Ralph Chatham, USN, of DARPA.

Subjects covered on the topic of anti-terrorism included trends in international terrorism by Stanley Bedlington, private consultant; detection of explosives and plastic guns by Paul Horowitz of Harvard, and technical development in terrorism and anti-terrorism by Philip Dean and Daniel Hogan, private consultants.

The subject of high-temperature superconductors was of great interest to the DSSG and, in fact, to the nation in light of recent technological breakthroughs. It was decided by the DSSG to set aside three hours each day to include a talk or a working session on this topic. The talks on high-temperature superconductors and future DoD applications for superconductors were given by Kay Rhyne of DARPA; Henry Kolm of the MIT National Magnet Laboratory; Edgar Edelsack, consultant to ONR; and Fernand Bedard of the National Security Agency.

#### **4. Winter Review Session**

The final session of the DSSG in FY 1987 was directed at summarizing all activities for the year and discussing them with IDA, the DSSG mentors and DARPA.

Steven Koonin and Warren S. Warren had been chosen at the September meeting as the organizers for the review session. It was agreed at that time that the review session would include a series of brief abstracts, a review of the trips, and a discussion of some of the topics that the DSSG explored.

Dr. Craig Fields, Deputy Director for Research at DARPA, started the session by briefly discussing a list of ten study topics of interest to DARPA that the DSSG could consider researching during the third year of the program. Topics are identified and described in Fig. 3.

**Figure 3. Topics of Interest to DARPA**

**1. Manufacturing Technology**

What high risk-high payoff ideas could DARPA invest in that would improve manufacturability, maintainability, or reliability, and span a range of DoD interests? What is not desired are ideas that are essentially specific, single-purpose applications such as many suggestions coming from materials research or ideas that are so general that they could mean almost anything, such as suggestions often coming from the computer sciences.

**2. The Utility of a Teraflop ( $10^{12}$ ) Computer**

With the development of gallium arsenide technology and massive parallelism, it now appears feasible to build a teraflop computer. Such a machine would greatly extend the current state of the art (2.5 to 3 gigaflops). What uses could such a machine be put to that would justify its development cost?

**3. Mechanical Engineering for Increased Reliability**

What technologies and research should be pursued in order to increase the reliability of mechanical as opposed to electrical components?

**4. Microelectronics Packaging**

What new and unusual ideas are there to address the problems of heat dissipation and electrical noise so that microelectronics can be packaged in smaller volumes?

(continued)



**Figure 3. (continued)**

**5. Artificial Intelligence**

There have been significant advances over the past ten years in developing AI systems; in particular, for speech and pattern recognition. Are there ways to measure the performance of such systems?

**6. Applied Mathematics**

Recent advances in this field having useful applications include the development of faster, fast Fourier transforms, and the fractal representation of base vectors for image compression. What new problems in this area could profitably be addressed?

**7. Robotics**

How should the current DARPA program be expanded? What are the prospects for the field of microrobots, and what activities might be usefully funded in this area?

**8. Semiconductor Manufacturing**

What novel ideas are worthy of pursuit in this area, particularly with respect to decreasing the initial capital outlay associated with establishing a manufacturing facility? Some ideas that have already been proposed include the use of movable cocoons for manufacturing to substantially decrease cleanliness requirements, and the use of x-ray lasers for the dry processing of chips which might cut the number of processing steps down from about 200 to about 40, thereby increasing yield.

**9. High-Temperature Superconductivity**

While 10 contracts have already been awarded by DARPA in this area and another 40 are likely by the end of FY 1988, much of the current work deals with the background science, component development, and the application of the new materials to existing component and system ideas. There is a desire for novel ideas that address fundamentally new applications that would not have been possible without these new materials.

**10. Power Sources**

There are many ideas around for improvements in power sources such as diesel engines, turbine generators, solid state batteries, fuel cells, etc. There are also many needs. What are some good projects for DARPA to pursue?

Thomas Rosenbaum next gave some observations on the benefits that DoD has gained from the DSSG program in terms of a research grant from the Office of Technology Assessment and two research grants from DARPA; new interactions with staff at various NASA facilities, Wright Patterson Air Force Base, Los Alamos National Laboratory, and Lawrence Livermore National Laboratory; and new areas of research being developed at DSSG members' home universities in areas of interest to DoD. DSSG members have also served as technical reviewers on IDA papers for the DoD.

Frederick Lamb spoke on Monitoring Yields of Underground Nuclear Tests, a subject he has been pursuing since his interest was aroused by the DSSG Spring Meeting of 1986 at a session on the subject of Surveillance and Verification of Arms Control. A particular talk on the state of technology in seismic detection and identification of underground explosions piqued his interest. He began research on hydrodynamic yield estimation at the following summer session and continues it to this time.

The meeting continued the following day at IDA and began with a talk by Philip Marcus, who gave an synopsis of the DSSG FY 1987 program and the DSSG reactions to what they saw and learned.

The concluding talks by DSSG members were on topics in which they became interested while participating in the DSSG this year and to which they devoted some time. These topics were:

Subject	Researchers
Operational Summary and Preliminary Research Status of the DSSG Subgroup on Infrared Detector Technology	Katherine Faber Nathan Lewis Thomas Rosenbaum Steven Sibener R. Stanley Williams Russel Caffisch Warren Warren
Mechanical Applications of High Temperature Superconductors	Steven Koonin W. Hugh Woodin
Blue-Green Lasers and Communications with Submarines	R. Stanley Williams

A summary of the presentations at the Review Session can be found in Appendix D. The session concluded after a meeting of IDA and the DSSG participants and mentors on future plans and directions for the DSSG.

## **B. ASSESSMENT**

The objectives of the second year of this program to continue to provide the select group of participants from the scientific community with an awareness of technological problems of national defense and to stimulate a desire among them to contribute to the solutions were accomplished. A balanced program of education and research was also successfully developed.

This second year has seen a remarkable advance in establishing and strengthening contacts with DoD units. Also, several topics which were introduced the first or second year have sparked interest, and research activity is continuing or under way. Work on verification of underground nuclear tests appears to represent a contribution to the solution of an outstanding defense problem. Work on detector materials, submarine communications, applications of high  $T_c$  superconductors, and radar countermeasures shows promise.

The establishment of strong ties and close working relationships among the members of this multidisciplinary group has exceeded the most optimistic expectations envisioned by IDA and the mentors. The DSSG participants now express the desire to remain together in some form after the conclusion of their commitment to the program. Plans are being formulated to put into place a mechanism by which former DSSG members can continue to apply their talents to the solution of outstanding defense problems.

## **C. FUTURE PLANS**

The principal objectives of the third year of the DSSG are (1) to provide adequate time to conduct and complete defense-related research projects, (2) to facilitate individual involvement by DSSG participants in defense research subsequent to membership in the DSSG, and (3) to select a new group of DSSG participants.

The third year of the DSSG program will focus almost exclusively on intensive research. A two-day trip to the Army National Training Center at Ft. Irwin, CA, is the only planned official site visit. Any other visits during the year will be at the request of individual participants and in support of their research projects. The FY 1988 schedule will

consist of two summer meetings, one at a summer study site to conduct research on topics of interest and the other at IDA to complete the research. A late fall review meeting will be held to present the final work to IDA, the DSSG mentors and DARPA. Philip Marcus and Randy Katz were chosen as the organizers for the first summer meeting. Bruce Hajek and Deborah Joseph were chosen as the organizers for the second summer meeting.

A search will begin during FY 1988 to identify new members for the FY 1989 DSSG program. A Search Committee (consisting of one mentor, Richard Bernstein, and two participants, Russel Caflisch and Deborah Joseph) was established to assist the program director, Robert E. Roberts, in identifying qualified candidates for future membership in the DSSG. It is intended that the new membership will be in place by the fall of 1988 so they may be invited to the final review session to meet with those who will be leaving the program. This should facilitate the transition between groups. In addition, two of the original DSSG members who had to curtail their participation during the first year will continue for one more year as will the three members who were added in FY 1987.

It was determined that a new group of members would be selected and established every three years instead of a staggered format with one-third replaced annually. It was strongly felt by IDA, the mentors and the participants, with the concurrence of the Director of DARPA, that a close camaraderie is established among people who share educational experiences, which makes for a smooth working relationship. It is believed that replacing one-third of the group every year could cause problems with the continuity needed to develop research over a three-year period.

Figure 4 shows the schedule of meetings planned for FY 1988. The principal thrust of the program, as explained above, will be to conduct research on study projects of key scientific and technical problems of national security.

**Figure 4. Schedule for 1988**

<b>June 1988</b>	<b>A nine-day session will be held beginning with a two-day visit to the National Training Center in Ft. Irwin, CA, and ending with a seven-day working session at Lawrence Livermore National Laboratory to conduct research on problems relating to national defense.</b>
<b>August 1988</b>	<b>A nine-day session at IDA will focus on completion of individual and group research of outstanding defense problems. Draft reports on research activities will be prepared.</b>
<b>September 1988</b>	<b>A final two-day meeting will be held to present research results, to transition between old and new members, and to discuss the FY 1989 program.</b>

## **APPENDIX A**

### **MEMBERS AND MENTORS**

## DEFENSE SCIENCE STUDY GROUP MEMBERS

RUSSEL E. CAFLISCH	Courant Institute of Mathematical Sciences, New York University
STEVEN K. CASE	Electrical Engineering, University of Minnesota
VICKI CHANDLER	Institute of Molecular Biology, University of Oregon
KATHERINE T. FABER	Materials Science and Engineering, Northwestern University
BRUCE HAJEK	Electrical and Computer Engineering, University of Illinois
DEBORAH JOSEPH	Computer Science, University of Wisconsin
RANDY H. KATZ	Computer Science, University of California, Berkeley
STEVEN E. KOONIN	Theoretical Physics, California Institute of Technology
FREDERICK K. LAMB	Physics, University of Illinois
NATHAN S. LEWIS	Chemistry, Stanford University
PHILIP S. MARCUS	Astronomy and Applied Mathematics, University of California, Berkeley
THOMAS F. ROSENBAUM	Physics, James Franck Institute, University of Chicago
STEVEN J. SIBENER	Chemistry, James Franck Institute, University of Chicago

DANIEL L. STEIN

Physics,  
University of Arizona, Tucson

WARREN S. WARREN

Chemistry,  
Princeton University

R. STANLEY WILLIAMS

Chemistry,  
University of California, Los Angeles

W. HUGH WOODIN

Mathematics,  
California Institute of Technology



## **DEFENSE SCIENCE STUDY GROUP MENTORS**

DANIEL ALPERT	Director, Center for Advanced Studies University of Illinois
RICHARD B. BERNSTEIN	Professor of Chemistry, University of California, Los Angeles
R. STEPHEN BERRY	Professor of Chemistry, University of Chicago
SOLOMON J. BUCHSBAUM	Executive Vice President, Bell Laboratories Chairman, White House Science Council; Member, Defense Science Board
PETER CARRUTHERS	Head, Department of Physics, University of Arizona
RUTH M. DAVIS	President, Pymatuning Group, Inc.; Former Assistant Secretary of Energy for Resource Applications; Deputy Under Secretary of Defense for Research and Advanced Technology
ALEXANDER H. FLAX	Member, Defense Science Board; President Emeritus, Institute for Defense Analyses
ANDREW J. GOODPASTER	Former Supreme Allied Commander, Europe; President Emeritus, Institute for Defense Analyses
ISAAC C. KIDD, Jr.	Former Supreme Allied Commander, Atlantic; Former Commander-in-Chief, Atlantic and U.S. Atlantic Fleet
MARTHA KREBS	Associate Director for Planning and Development, Lawrence Berkeley Laboratories; Former Staff Director of the Subcommittee on Energy Development and Applications of the Committee on Science and Technology, 97th Congress

PETER LAX

Director, Courant Institute,  
New York University

STANFORD S. PENNER

Director, Center for Energy and Combustion  
Research, University of California, San Diego

DAVID PINES

Professor of Physics and Electrical Engineering,  
University of Illinois

WILLIAM H. PRESS

Chairman, Department of Astronomy,  
Harvard University

HERBERT YORK

Director, Science, Technology and Public Affairs,  
University of California, San Diego;  
Former and First: Director of Defense Research and  
Engineering  
Chief Scientist, Advanced Research Projects Agency  
Director, Lawrence Livermore Laboratory

**APPENDIX B**

**MEETING AGENDAS**

**DEFENSE SCIENCE STUDY GROUP  
SPRING TECHNICAL MEETING  
IDA BOARD ROOM  
MAY 8-9, 1987**

**AGENDA**

**Friday, May 8, 1987**

0825-0830	Welcome	Dr. Robert Roberts
<b>NAVAL OPERATIONS AND CAPABILITIES</b>		
0830-0840	Opening Remarks	VADM. David Jeremiah Director, Navy Program Planning Office
0840-0910	Technology in Naval Operations	RADM Charles Brickell, Jr., Director, Undersea and Strategic Warfare and Nuclear Energy Development Division, Office of Research, Development and Acquisition
0910-0935	Overview of U.S. Navy	CAPT. William Baker, Office of Assistant Secretary of Defense (Public Affairs)
0935-1005	Soviet Naval Threat	CDR. Michael DeRusso, Navy Operational Intelligence Center
1005-1015	Break	
1015-1045	U.S. Maritime Strategy	CDR. Alan Ross, Strategic Concepts Group
1045-1115	Naval Submarine Operations	LCDR. Eugene Matranga, Attack Submarine Division
1115-1210	U.S. Navy R&D	Dr. Philip Selwyn, Director, Office of Naval Technology
1210-1300	Lunch	
1300-1400	Operational Testing and Evaluation of Hardware Systems	Dr. Ernest Seglie, IDA/OED
1400-1430	DSSG Program Activities in 1987	Dr. Robert Roberts
1430-1445	Break	
1445-1545	Meeting of Mentors (Rm. 305N)	Dr. Robert Roberts
1900-	Reception	Board Room

**Saturday, May 9, 1987**

**DEFENSE RESEARCH & DEVELOPMENT: BUDGET AND POLICY ISSUES**

0830-0850	Continental Breakfast	
0850-0900	Introduction	Dr. Martha Krebs
0900-0945	A View from the House of Representatives	Mr. Anthony Battista, Staff Member, House Armed Services Committee
	A View from the Executive Office of the President	
0945-1005	Office of Management and Budget	Dr. Robert Howard, Deputy Chief, National Security Division
1005-1030	Office of Science and Technology Policy	Dr. Thomas Rona, Assistant Director for Government Programs
1030-1045	Break	
1045-1130	A View from the Senate	Dr. Edward McGaffigan, Legislative Aide to Senator Jeffrey Bingaman (D-New Mexico) Member, Armed Services Committee
1215-1330	Lunch	Cafeteria
1330-1500	Discussion Among Participants	
1500-1630	Summary and Wrap-up	

**DEFENSE SCIENCE STUDY GROUP  
TOUR OF NAVAL OPERATIONS**

**June 21-July 2, 1987**

**ITINERARY**

June 21-26	San Diego
June 26-28	Seattle (Bremerton)
June 28-July 2	Honolulu

**Sunday, June 21, 1987**

Travel to San Diego

Arrive:

Bachelor Officers' Quarters (BOQ)  
Naval Training Center  
Harbor Drive  
San Diego, CA  
(619) 225-4508

**Evening at Leisure**

**Monday, June 22, 1987**

Breakfast (Optional)

Seasons Restaurant (fast food style)

4865 Harbor Drive

- 5 min. walk from BOQ (one crosswalk away)
- Opens at 6AM

0730-

Bus arrives at BOQ

0745-

Bus departs BOQ en route NOSC

0810-1200

Naval Ocean Systems Center (NOSC)  
Topside, Bldg. 33  
(Coffee and donuts provided)

0810-

- Role of Navy R&D Centers  
Dr. Robert Hillyer, Technical Director

0840-

- Navy Technology Directions  
Dr. John Silva, Program Director for Technology

0915-

- Non-acoustic ASW  
Optical Detection  
Arctic ASW  
Rod Buntzen, Head, Environmental Research Branch

1015-

- Submarine Laser Communications  
Greg Mooradian, Space Systems Division

1145-

Bus to Bayside

1200-1300

Lunch at the Dolphin Facility  
(IDA to pay for DSSG Members)

1300-1400

DSSG Meeting  
Bldg. 128, Auditorium

1400- Bioluminescence, Bldg. 111  
Jon Losee  
David Lapota  
Radiation Physics Branch

Remote Sensing Bioluminescence  
Ken Richter, Marine Environment Branch

1530- Bus to Battery Ashburn North

1545- Microelectronics, Bldg. 560N  
Gene Kelley  
Head, Product Development and Environment Branch

1630- Bus to Lab.

1635- Arctic Submarine Lab Tour, Bldg. 371  
Capt. Merrill Dorman  
Director, Arctic Submarine Lab.

1715- Bus departs NOSC for return to BOQ

**Evening at Leisure**

**\*\*NOTE: Admiral Kidd Officers' Club Closed on Monday\*\***

**Tuesday, June 23, 1987**

Breakfast (Optional)  
Seasons Restaurant (See Mon, 6/22 listing)

0815- Bus departs BOQ for Naval Air Station,  
North Island (Airfield)

0840-0915 Check in procedures for helicopter (helo) flight

Group A:

Cafilisch  
Chandler  
Hajek  
Katz  
Lamb  
Licato  
Roberts  
Sibener  
Stein  
Williams  
Woodin

Group B:

Bergemann  
Case  
Faber  
Joseph  
Koonin  
Krebs  
Lewis  
Marcus  
Rosenbaum  
Smith  
Warren



0915-0945	Group A - Helo flight to USS Gary (FFG-51) Commanding Officer - CDR Bethea
	Group B - Helo flight to USS Ford (FFG-54) Commanding Officer - CDR Eckler
0945-1530	Observe Underway Operations on board FFG
1545-	Group A - Depart USS Gary Group B - Depart USS Ford  (Helo flight to NAS North Island)
1615-1630	Arrive NAS North Island
1645-	Bus departs en route BOQ
1715-	Arrive BOQ

**Wednesday, June 24, 1987**

	Breakfast (Optional) Seasons Restaurant (See Mon., 6/22 listing)
0830-	Bus departs BOQ for NAS North Island
0845-	Bus arrives USS Ranger (CV-61) (Aircraft Carrier)
0900-1145	Tour USS Ranger (CV-61) Commanding Officer--Capt. Don Baird
1145-1230	Lunch on board USS Ranger (Crew dining facility--"Mess Decks")
1240-	Bus leaves USS Ranger en route transient flight line
1300-1440	Anti-submarine Warfare Aircraft Static Display: • 4 Aircraft w/power and tapes loaded VS Aircraft (S-3) HA Aircraft (SH-3/LAMPS I and III)
1440-	Bus leaves en route USS Chandler (DDG-996) (Guided Missile Destroyer) Commanding Officer: CDR Steve Smith
1500-	Arrive USS Chandler
1500-1700	Tour USS Chandler

1715- Bus leaves USS Chandler en route BOQ

1735- Arrive at BOQ

**Evening at Leisure**

**Thursday, June 25, 1987**

Breakfast (Optional)  
Seasons Restaurant (See Mon., 6/22 listing)

0830- Bus departs BOQ for NAS, Miramar

0900 (Approx) Arrive NAS Miramar

0900-1200 NAS Miramar--Tour  
• Navy Fighter Weapons School  
• Tactical Aircrew Training System  
• VF Simulator

1200- Bus departs for Officers' Club

1205-1300 Lunch at Miramar Officers' Club  
(No host)

1300- Bus departs for Naval Amphibious Base

1330- Arrive Amphib Base Coronado

1345-1645 Special Warfare Indoctrination  
• Welcoming remarks by Commodore  
• Video on seal operations  
• Static display - Personnel/Equipment  
• Discussions with Commanding Officers of Seal Teams

1645- Bus departs Amphib Base for BOQ

1700- Bus Arrives at BOQ

**Evening at Leisure**

**Friday, June 26, 1987**

**San Diego to Bangor, Washington**

0600- Bus departs BOQ for Airport

0700- (United Flight #1272) to Seattle, WA

0930- Arrive Seattle, WA

1000- Bus leave Seattle Airport en route  
Silverdale Hotel & Resort  
3073 NW Bucklin Hill road  
Silverdale, WA 98383  
(206) 698-1000

1130-1215 Arrive/Check-in Silverdale Hotel

1215- Bus departs hotel to Naval Submarine Base, Bangor

1245-1330 Lunch at Sub Base Banquet Facility  
(IDA to pay for DSSG Members)

1315-1330 Base overview/orientation briefing  
(During lunch at banquet facility)

1330- Bus departs for Strategic Weapons Facility Pacific (SWFPAC)

1345-1500 SWFPAC  
- Introduction by Commanding Officer  
- Tour of SWFPAC MAB 1  
- Explosive Handling Wharf

1500- Bus departs SWFPAC en route Trident Refit Facility

1510-1600 Trident Refit Facility  
- Welcome from Commanding Officer  
- Briefing and walking tour

1600- Bus departs Refit Facility en route Trident Training Facility

1610-1730 Trident Training Facility  
- Commanding Officers' Welcome  
- Walking Tour

1730- Bus departs Sub Base for Hotel

1800- Arrive Hotel

**Evening at Leisure**

**Saturday, June 27, 1987**

0700-0745	Breakfat at hotel (Optional)
0745-	Bus departs hotel for Bangor Naval Base
0800-	Arrive Bangor Naval Base
0800-1015	Delta Refit Pier - Tour of SSBN
1030-	Bus departs Sub base for hotel
1100-1400	Lunch at Leisure
1400-1600	DSSG Meeting Silverdale Hotel Conference Room Canal Room

**Evening at Leisure**

**Sunday, June 28, 1987**

0715-	Bus leaves Silverdale Hotel for Seattle Airport
0900-	Arrive Seattle, WA Airport
1000-	Depart Seattle, WA (United Flight #33)
1237-	Arrive Honolulu, Hawaii, Airport (Meet at baggage claim area)
1315-	Bus departs airport en route BOQ
1340-	Arrive at Naval Station, Pearl Harbor BOQ (808) 474-1201

**Evening at Leisure**

<p><b>NOTE: PEARL HARBOR OFFICERS' CLUB (WALKING DISTANCE FROM BOQ) HOURS OF OPERATION</b></p>
<p><b>BREAKFAST: 0600-0800 (Mon-Fri)</b></p>
<p><b>LUNCH: 1100-1300 (Mon-Fri)</b></p>
<p><b>DINNER: 1800-2100 (Tues-Sat)</b></p>

## **Monday, June 29, 1987**

Breakfast at Officers' Club (Optional)

0745- Bus departs BOQ en route NOSC-Kaneohe

0830-1130 NOSC-Kaneohe  
• Marine Mammals

1140-1230 Lunch at Marine Corps Air Station  
Kaneohe Officers' Club

1300- Bus departs to NAS Barbers Point  
- Hangar 282

1330-1645 Tour of VP/VQ/VPU-2  
• VP Anti-Submarine Squadron  
• VPU-2 Special Projects (Photo/Intel/Electronic)  
• VQ Communications w/Submarines

1650- Bus departs for BOQ

1715- Bus arrives at BOQ

### **Evening at Leisure**

## **Tuesday, June 30, 1987**

Breakfast at the Officers' Club (Optional)

0730- Bus departs BOQ

0800- Bus arrives Camp Smith  
(Commander in Chief, Pacific - CINCPAC)

0815-0915 Pacific Area Update (Brief)

0915-0925 Walk to Intelligence Center/Pacific (IPAC)

1030-1030 Tour of IPAC

1030-1040 Walk to CINCPAC

1045-1155 Dr. Fallin Presentation  
• Identified Operational Deficiencies  
• R&D issues

1200-1300 Lunch and CINCPAC Officers' Club  
(No host)

1300- Bus departs en route Subase Pearl Harbor

1315- Bus arrives Subase

1315-1630	COMSUBPAC <ul style="list-style-type: none"><li>• SSN Tour</li><li>• Training Facility Tour</li><li>• Arctic ASW Brief</li></ul>
1630-	Bus departs Subase for BOQ
1645-	Bus arrives at BOQ

**Evening at Leisure**

**Wednesday, July 1, 1987**

	Breakfast at Officers' Club (Optional)
0715-	Bus departs Naval Station BOQ
0730-	Arrive CINCPACFLT Landing
0800-	Tour Boat departs
	Arizona Memorial Tour
0900-	Arrive Landing "A"--Ford Island
0900-1200	Tour/Briefs at COMOCEANSYSPAC/NOPF <ul style="list-style-type: none"><li>• Commander Ocean Systems Pacific</li><li>• Naval Ocean Processing Facility</li></ul>
1205-	Board Boat at Landing "A"
1215-	Arrive CINCPACFLT Landing and board bus
1220-1320	Lunch at Marina Club
1320-	Board Bus
1330-	Arrive at CINCPACFLT
1330-1445	DSSG Meeting (Conference Room)
1445-	Bus departs CINCPACFLT en route BOQ
1500-	Arrive at BOQ

**Evening at Leisure**

**Thursday, July 2, 1987**

	Breakfast at Officers' Club (Optional)
0845-	Bus leaves BOQ
0900-1000	CINCPACFLT Command Brief <ul style="list-style-type: none"><li>• Threat</li><li>• Current Naval Operations</li></ul>
1000-1200	C <sup>3</sup> Architecture <ul style="list-style-type: none"><li>• Operations Support Group Prototype</li><li>• Battle Management Program</li></ul>
1205-	Bus departs CINCPACFLT en route BOQ
1210-	Bus arrives at BOQ
PM	Departure of DSSG Members Means of departure to own destination up to each member

**DEFENSE SCIENCE STUDY GROUP MEETING**  
**SEPTEMBER 18-22, 1987**  
**AGENDA**

**FRIDAY, SEPTEMBER 18 (Room 438--SofTech)**

8:30 a.m.	INTRODUCTION	R. Roberts
8:45 a.m.	SURFACE SHIP TORPEDO DEFENSE	
9:00 a.m. - 10:00 a.m.	Overview	John Klisch, Naval Sea Systems Command
10:00 a.m. - 11:00 a.m.	Technical Aspects of the Program	Marshall Anderson, Naval Coastal Systems Center
11:00 a.m. - 12:00 noon	Discussion and Question Period	
	Invitees:	
	Alfred Kaufman, SED	
	CAPT J. Berg, USN, Naval Sea Systems Command	
	CDR J. Allison, USN, CNO Executive Panel (Intelligence)	
p.m.	Scheduled Work Sessions	

**SATURDAY, SEPTEMBER 19 (ROOM 438--SofTech)**

8:30 a.m.	SUPERCONDUCTORS	
8:30 a.m. - 9:30 a.m.	High Temperature Superconductors	Kay Rhyne, DARPA
9:30 a.m. - 10:30 a.m.	Prolonged Adolescence of Superconductors	Henry Kolm, MIT National Magnet Lab.
1:30 p.m.	SPACE DEBRIS	
2:00 p.m. - 2:45 p.m.	Review of Space Debris Issues	Donald Kessler, NASA Johnson Space Center
2:45 p.m. - 3:00 p.m.	Question Period	
3:00 p.m. - 3:45 p.m.	Review of Space Debris Issues	Nicholas Johnson, Teledyne Brown
3:45 p.m. - 4:00 p.m.	Question Period	
4:00 p.m. - 5:00 p.m.	Open Discussion	



## **SUNDAY, SEPTEMBER 20**

### **Scheduled Work Sessions**

## **MONDAY, SEPTEMBER 21 (Room 438--SofTech)**

8:30 a.m. **SUBMARINE LASER COMMUNICATIONS**

9:00 a.m. - 10:00 a.m. Navy Overview Tom Kaye,  
Naval Ocean Systems Command

10:00 a.m. - 11:00 a.m. Systems and Science Overview CDR R. Chatham,  
DARPA

### **Invitees:**

CAPT Terence Danner, USN, OP-943

CAPT F.P. Gustavson, USN, OP-224

CDR J. Allison, USN, CNO Executive Panel (Intelligence)

p.m. **Scheduled Work Sessions**

## **TUESDAY, SEPTEMBER 22 (Room 396--SofTech)**

8:30 a.m. **ANTI-TERRORISM**

8:30 a.m. - 9:15 a.m. Trends in International Terrorism Stanley Bedlington,  
CIA

9:15 a.m. - 10:00 a.m. Detection of Explosives and Plastic Guns Paul Horowitz,  
Harvard

10:00 p.m. - 10:45 a.m. Break

10:45 a.m. - 11:30 a.m. Technical Developments in Terrorism and Anti-Terrorism (Bedlington to  
nominate)

### **SUPERCONDUCTORS**

2:00 p.m. Future DoD Applications of High Tc Superconductors Edgar Edelsack,  
ONR Consultant,  
and  
Fernand Bedard, NSA

**DSSG WINTER MEETING  
DECEMBER 4-5, 1987**

**AGENDA**

**FRIDAY, DECEMBER 4**

**BEECH RM., RADISSON HOTEL**

1:00-1:15	Welcome	R. Roberts
1:15-2:15	DARPA Programs Current and Future	C. Fields
2:15-2:45	Discussion	
2:45-3:00	Break	
3:00-3:30	DSSG Study Program Long-Range Effects	T. Rosenbaum
3:30-4:00	Discussion	
4:00-4:30	Monitoring Yields of Underground Nuclear Tests	F. Lamb
4:30-5:00	Discussion	
6:30	Dinner Reception	IDA Board Room

**SATURDAY, DECEMBER 5**

**IDA BOARD ROOM**

8:00	Continental Breakfast	
8:30-9:00	Overview of FY 87 Program	P. Marcus
9:00-9:30	Discussion	
9:30-10:00	IR Detector Technology	N. Lewis
10:00-10:30	Discussion	
10:30-11:00	Mechanical Applications of High Temperature Superconductors	H. Woodin
11:00-11:30	Discussion	
11:30-12:00	Blue-green Laser Communications	S. Williams
12:00-12:30	Discussion	
12:30-1:30	Lunch	IDA Cafeteria
1:30-2:00	Future Directions	DSSG
2:00-3:30	--Participants' Discussion	Board Room
	--Mentors'/IDA Discussion	Room 203N
3:30-5:00	Joint Session and Wrap Up	

**APPENDIX C**

**MEETING MINUTES BY MEMBERS**

## MINUTES OF THE 1987 MAY DSSG PLANNING MEETING

### GENERAL

DSSG members very much appreciate the many efforts that Dr. Roberts, Nancy Licato, numerous IDA staff members, and others have already made to set up a successful program for 1987.

DSSG members ask that the program manager and relevant IDA staff pay closer attention to DSSG recommendations summarized in the minutes of group planning meetings and that they consult with the group when departures from these recommendations seem useful or unavoidable. In particular, the DSSG members ask that the program manager and relevant IDA staff consult the minutes of the 1986 November planning meeting for continuing guidance in setting up this year's program.

In planning for future meetings, DSSG members want to have a stronger voice in the selection of briefing topics and briefers, and in the development of schedules. It was felt that the approach used in 1986 to develop the program for the Spring and Summer Meetings (selection of topics by the group followed by draft memos on each topic by specific group members for guidance of IDA staff) was generally more successful than the approach used this year and should be used in the future. In general, it was felt that the briefings that have been most successful were those which were arranged by a DSSG Senior Advisor or IDA staff member in consultation with one or more members of the DSSG. In order to facilitate this approach in the near term, the group will appoint two members as key points of contact for each of the remaining 1987 meetings.

In the schedules of future meetings, DSSG members request that they be allowed more time to discuss briefings with each other and to confer on the progress of the program.

In order to facilitate closer interaction between DSSG members and IDA staff, IDA should furnish members with the IDA booklet containing photographs and biographical

data on staff members. The DSSG would also be interested in additional briefings by IDA members on work going on at IDA that is of interest to group members.

DSSG members were surprised that their draft reports prepared for the 1986 November meeting were sent out for external review without the authors being consulted. The group felt that, if possible, something should be done to try to undo the damage that may have been done to the reputation of the group and the reputations of group members by this action. The group was uncertain whether it would be better to write to reviewers explaining what had happened or to avoid calling further attention to these draft reports by simply dropping the matter. In the end, the group decided that the authors of each draft report should decide in consultation with each other and Bob Roberts what action, if any, to take.

## JULY MEETING

The DSSG members chosen as key points of contact between IDA and the group for the first 1987 Summer Meeting are Kathy Faber and Dan Stein.

DSSG members recognize and appreciate the special opportunity represented by the eleven days of site visits planned for the 1987 June-July Meeting. Given that this period is significantly longer than that decided upon at the 1986 November planning meeting, allowing individual participants to participate in part of the schedule is appropriate, if necessary. Members recognize the need for letting IDA know promptly which site visits they can make and for following through on this commitment.

DSSG members recognize the importance of introductory briefings at each site, but request that the other on-site briefings to be more technical in nature, as is appropriate given the backgrounds and interests of group members.

As mentioned above under General, DSSG members strongly request that they be allowed more time to discuss briefings with each other and to confer on the progress of site visits. Specifically, DSSG members request that, whenever possible, time be formally set aside each day for private meetings of the group. A convenient time might be one to one and a half hours right after lunch, and in the evening. Given a choice between a social event or a group meeting in the evening, most members of the group would prefer a group meeting. We recognize that on some days such meetings may be inappropriate or impossible because of the nature of the activities scheduled. It will help to avoid frustration

if the schedule is developed in consultation with Kathy and Dan, who can convey the constraints to the larger group.

During this meeting the DSSG will select two sets of two members each to serve as points of contact between IDA and the group for the September and November meetings.

## SEPTEMBER MEETING

The best (and just about the only) dates during which all group members could be present in September were the 18th-22nd, inclusive. Other than this period, two members would be unavailable during the weeks of September 7 to October 2. Many more members would be unavailable if the meeting were held outside this latter interval.

IDA planning for the September meeting (in particular, selection of speakers, if any) should be done in close consultation with the DSSG members serving as points of contact.

Given the length of the June-July meeting, some DSSG members almost certainly will not be able to attend in September for more than the five days required to meet their annual commitment to the group.

Some DSSG member suggested devoting several hours at this meeting to reports by group members on what they do professionally outside the DSSG.

## NOVEMBER MEETING

Dates for the "November" meeting remain to be decided at the June-July meeting. Members should bring their schedules.

Many DSSG members expressed interest in hearing further from DARPA about its *current concerns* in an informal setting that would facilitate discussion. It was suggested that the November meeting might be the most appropriate time for such sessions.

## ANNUAL REPORT

Given the nature of the DSSG program (largely briefings and site visits, with only a few days available for study and research), the participants do not think that attempting a research paper for submission to DARPA is an appropriate way to summarize the year's activities.

The DSSG does recognize the need to conclude the year's activities in some appropriate fashion and to provide DARPA with an annual report of some kind. One option would be preparation of a 2-5 page descriptive report on the study and research pursued by each subgroup, but without any pretense that these reports represent a summary of original, let alone completed, research. If some members do wish to submit a more formal research finding, this should also be possible. The length and format of any face-to-face meeting with DARPA staff was not decided. Members will confer with each other and Dr. Roberts during the June-July and September meetings to decide the best way to meet this need.

The group concluded that, while in some cases members might become involved in full-scale research on defense-related problems while participating in the three-year DSSG program (particularly if they are already involved in related research), in general this is not to be expected. Such involvement, if it occurs at all, is more likely to occur after the three-year 'survey' is over and members have a broader perspective. However, it was felt that IDA and DARPA are nevertheless already receiving a significant return on their investment, in the form of involvement of some group members with specific DARPA problems, facilitation of contacts with students at member institutions, etc. In general, the group felt that this kind of return is the kind that is realistic to expect, in contrast to research reports on DARPA (or other) problems prepared by group members during the few days available for research and study each year during DSSG meetings. In order to document such returns (probably most appropriately in anecdotal form), DSSG members will inform Dr. Roberts of relevant information. In addition, the DSSG appointed Tom Rosenbaum to collect such information and to work with Dr. Roberts in reviewing it and communicating it in an appropriate way to DARPA.

## **MINUTES OF JUNE 27, 1987 DSSG MEETING**

### **GENERAL**

Fred Lamb expressed his appreciation to the DSSG for investing in him the responsibility of minutes secretary, but felt that the time to bring in new blood had come. Dan Stein will be taking over for the June trip, having edged in front of a crowded field. The DSSG expressed its appreciation to Fred for a year and a half of faithful service. The opinion was expressed that minutes be recorded in a calm and statesmanlike manner.

The DSSG greatly appreciates the extensive efforts of Bob Roberts and Nancy Licato on their behalf, and their work with CDR. John Allison on the June trip in particular. To express this appreciation, Bob, Nancy, and John will be taken out to dinner at a Thai restaurant in Honolulu.

### **GOALS FOR 1988 PROGRAM**

Many DSSG members feel that the group should begin to focus on longer term projects with a possibility of continuing to work together as a group beyond the third year of the program. Since group discussion on this point would have an impact on the September meeting, it was decided to think about long-range planning and the shape of the 1988 program before discussing specifics of that meeting.

Many members expressed their feeling that next year be primarily focused on research, with less emphasis on site visits and education of the "cultural" variety. Several motivations for this feeling were given, including a desire to begin to look at one or a few problems in depth after almost two years of briefings and site visits, "payback" to IDA and DARPA after two years of generous support, and justification for keeping the present group together after the third year of the program. Those who supported this view expressed some differences as to the proper balance between briefings, site visits, and research in 1988. Some felt that site visits should be eliminated altogether, with speakers brought in to discuss in detail various research options. It was also suggested that a larger set of projects be proposed than can realistically be covered, as a hedge against possible



classification or other logistical problems. Others wished to keep some amount of site visits, although chosen with an eye toward research. It was also felt by some that the global nature of various issues beyond the technical aspects should be examined.

Several DSSG members expressed the concern that their areas of expertise do not lend themselves readily to research in the areas they've heard about so far. It was suggested that this might be less of a problem than at first appeared, since presence of the members helps to shape what the group sees and hears.

The feeling that research should take precedence next year was by no means unanimous. Some felt that the site visits were by far the best part of the program, which should remain educational. On the tours we see hardware that we normally would not have a chance to see, and we also have the chance to see the real world application of research. There was general agreement on both sides of the issue that DARPA should be consulted when research topics are chosen.

Some DSSG members expressed concern that the program would bifurcate next year between incoming members and third year people, since it would be hard to integrate the two. The possibility that the first year people separate and have their own briefings was rejected as unworkable since the briefings would then have very low attendance.

One possibility was that the program could be split up, with the emphasis of the first two years on educative briefings and site visits, and the third year on research. Some incoming members would begin on a research year, but integration might be possible in this way. The possibility of no new members was raised. Some felt that it would be good to focus early on specific projects in any case. However, the group decided that it should focus on its own progress and future direction, and not pay too much attention at this point to the problems involved with bringing in new members.

The group then decided to write down a list of possible research projects, with as wide a field of projects as possible. There was some debate as to whether these should be subdivided into three categories of topics: broad "cultural" themes, focused education topics, and narrow, specific research projects. In the end it was decided simply to choose four or five topics of interest to some large subset of DSSG members, which would form the basis of briefings and discussions in September; which of the three categories a topic fell into would vary from member to member depending on his or her background and tastes. Some members might wish to explore on their own other topics not chosen by the group.

The full list of topics is as follows:

1. Uses of high- $T_c$  superconductors
2. Space debris
3. Composite materials
4. Manufacturing technologies
5. Economic and industrial competitiveness
6. Nuclear weapons security (in particular PALs)
7. Blue-green lasers
8. Anti-terrorism
9. Anti-matter propulsion
10. Missile arming and disarming in flight
11. Arms control verification
12. Space Policy--moon versus space stations
13. Martian living
14. Man-machine interface, ship-board automation
15. High-intensity sound weapons
16. Remotely piloted or autonomous subs
17. Naval arms control
18. Torpedo countermeasures, including wake-homing torpedoes, acoustic camouflage, and multi-static sonar
19. Space plane
20. Missile volume arms control
21. New IR sensor materials
22. Sub/carrier tradeoffs (conflict modeling)
23. Teraflop computer applications
24. Arms sales

DSSG members were first asked to indicate which topics were of interest to them; each member was free to choose an unlimited number of topics. After a general sense of members' interests was obtained in this way, each person chose three topics of primary interest. Five topics were thereby selected for closer examination at the September

meeting. These included high- $T_c$  superconductors, space debris, anti-terrorism, blue-green lasers, and torpedo countermeasures.

## SEPTEMBER MEETING

The group views the meeting in September as a working session to acquaint the DSSG with possible research topics, serving in this way as an introduction to the third year of the program. At this point the DSSG feels that close contact be maintained between IDA and two DSSG members chosen as coordinators for each future meeting, in order to ensure a well-organized and well-planned meeting, and to keep DSSG input at a high level. The coordinators for the September meeting will be Russ Caflisch and Nate Lewis.

In addition, one person will coordinate organization of each of the five topics chosen by the group. These are:

- |                  |                             |
|------------------|-----------------------------|
| 1. Kathy Faber   | High- $T_c$ superconductors |
| 2. Tom Rosenbaum | Anti-terrorism              |
| 3. Stan Williams | Blue-green lasers           |
| 4. Warren Warren | Torpedoes                   |
| 5. Fred Lamb     | Space debris                |

Each topic coordinator will find appropriate speakers to brief the group on their subject, with the exception of high- $T_c$  superconductors (to be discussed below). This will probably involve close consultation with IDA personnel, DSSG mentors, or other knowledgeable sources, as each coordinator sees fit. Coordinators are to check with IDA before actual contact with a briefer is made; details should be discussed with Bob Roberts. Preferably, each coordinator will bring in two speakers, with the exception of space debris, where one speaker was deemed sufficient. It should be remembered that these rules are guidelines and not rigid constraints, although a topic coordinator overscheduling briefings may invite reprisals.

It was felt that the area of high- $T_c$  superconductors was too new for briefings to be of much use, or even to find suitable briefers. Instead, there will be a three hour working session each day for those interested; members are urged to read and/or bring to the meeting books and papers on applied superconductivity. These 3-hour sessions are not to be scheduled at the same time as the briefings.

Russ and Nate will hold a master schedule for the September meeting, with Russ assuming primary responsibility. Each topic coordinator is to stay in close consultation with them, and to notify them immediately when a speaker is obtained, with times when he/she might be available to brief the group. The two meeting coordinators are responsible for ensuring a balanced schedule and finding time for the superconductivity workshop. The possibility of evening meetings was proposed and rejected.

MCI mail will be used to send news of progress of the coordination of the meeting to all members as soon as this news is available.

The meeting format includes a briefing on a separate topic each day, a daily superconductor meeting as described above, and individual or group independent research. Saturday and Sunday will be regarded as ordinary working days. It is important to note that any individual's attendance at any briefing or workshop meeting is entirely up to that person, and that each member is free to pursue other topics or consult with Bob Roberts about bringing in additional people he or she may wish to talk to.

The actual briefing schedule would ideally involve two speakers (except for space debris), representing different points of view if possible, talking for one hour each with an additional hour for group discussion with the speaker. It would be highly desirable for speakers to remain at IDA for the rest of the day, so that interested members may have further discussion with them.

## NOVEMBER MEETING

Coordinators will be Steven Koonin and Warren Warren.

**Dates:** Some members cannot come in the period between November 18 and 23. Despite the fact that some members can come mid-week, it was agreed to hold the meeting on Friday and Saturday. All members can come on December 4 and 5, and all but one on November 13 and 14; that person can come for part but not all of the latter period. Two or more cannot come at all on November 6-7 and 20-21. It was therefore decided that the meeting should be held on December 4 and 5, with November 13-14 as a backup date. DSSG members are asked to keep these dates open.

At this point it was felt that DARPA input would be highly desirable, and the sole briefings would be from DARPA people. A possible model for such a meeting might be for the group to hand in a largely descriptive report (as opposed to research-style papers) of their years' activities and investigations, and future plans. The report would include

anecdotal material being collected at present by Tom Rosenbaum. In addition, some presentations might be given, although not on last year's scale, and the meeting might include discussion of the 1988 cycle and further working on projects.

## **MISCELLANEOUS**

Tom Rosenbaum requests that all those with anecdotal information arising from their contact with DSSG please write a brief (3-4 sentences) summary and send them to him as soon as possible.

Russ Caflisch suggested a possible trip to Wright-Patterson to talk to people there about composite materials. This might occur before the official September meeting begins. Interested parties should contact him soon so that the trip might materialize.

## MINUTES OF SEPTEMBER 21, 1987 DSSG MEETING

The meeting began with a review of some of the topics discussed at the June meeting. Attention focused on introduction of new members, particularly in light of the list of potential members provided by Bob Roberts. The group reiterated its position towards the introduction of new members, as recorded in the minutes of the June meeting. If new members are to be brought in, however, the group felt that top priority should be given to finding another person involved in the life sciences. Many also felt that the group would be well served by bringing in an aeronautical engineer, though it was pointed out that the species is near extinction within academe (at least in the 25-35 year old age group). It was also felt that the group could use someone within the geological sciences as well. The final consensus was that the current members of the DSSG should have considerable input into choosing new members.

On a different note, it was pointed out that Frank Hartmann had expended considerable effort in putting together the session on torpedo defense and deserved a note of thanks from the DSSG. The motion was unanimously approved.

## DECEMBER MEETING

The dates of this meeting will be December 4 and 5 (Friday and Saturday) and the organizers are Steve Koonin and Warren Warren. They and Steve Case discussed with Bob Roberts the presentation format. It was agreed that this would take place on Friday afternoon, and would include some accounting of the past year's activities. This might take the form of a series of brief abstracts, review of trips, and discussion of some of the topics we've learned about, and could possibly be delivered by a single person chosen by the group. At our last meeting we discussed the possibility of DARPA making a presentation to us in December. Bob Roberts had mentioned that some of that has taken place already, the most recent example being Dr. Rhyne's presentation to us at the current session. Two names that were suggested as possible DARPA people to talk with us in December are Craig Fields and Clint Kelly.

A suggested format for the meeting was that members should try to arrive Thursday night if they can, and spend that evening and Friday morning preparing a presentation. Friday afternoon would encompass the presentation itself and Saturday could be used for the group to plan the next year.

The presentation might be based on brief (half to full page) abstracts on topics of research interest submitted by each member (a collection of "bullets" would also be satisfactory). These might mention areas of possible or actual investigation which members have done, are doing, or might be interested in doing. Tom Rosenbaum will also discuss anecdotes which he has been collecting and organizing.

A debate ensued over whether members should send their abstracts in individually to the person who organizes and presents the report, or instead if this task would be better accomplished collectively. It was felt that to carry over the old groups from last year's research efforts was unnecessary. Some DSSG members proposed that the job be done immediately; this was effectively vetoed by the subsequent inaction of the group. The issues which remained were: should the abstracts be written by individuals, small groups, or one large group? Would they be written Thursday evening, Dec. 3, or earlier? The final decision was left up to each individual.

On the matter of actual presentation, the December organizers will decide whether one person or the whole group will make the final presentation to IDA and DARPA. It was also hoped that the presentation would be three-way, with the DSSG, IDA, and DARPA all speaking on projects of interest to them.

A proposal was made that the December meeting be limited to one day, but this was ultimately decided against by the group.

### THIRD YEAR PLANS

Two extreme views were presented. The first was that the final year consist of no briefings or field trips at all, and be devoted solely to research. If adopted, this would necessitate informing any incoming members about the group's nature. The other extreme was that next year be devoted solely to field trips, since these present an opportunity many of us are not likely to have again, at least in the near term.

DSSG activities were divided into three broad categories--briefings at IDA, field trips and research. There was a strong consensus that for our third year, briefings at IDA were to be cut back sharply or eliminated altogether. Some interest was expressed in

hearing from directors of research in the private sector or IDA staff members, but again subject to the above constraint.

The third year shall therefore consist of field trips and research, with the relative proportions to be decided by the actual nature of possible trips. There was a strong (but not unanimous) consensus that the group needs a big block of time for research; one formula proposed was that  $x$  days be allocated for trips, and  $20 - x$  for research, with  $3 \leq x \leq 10$ . It was stressed that the group should be cautious and not oversell its ability to deliver quickly on research results, but instead should try to make a solid beginning in one or a few areas by the end of the third year.

Possible field trips were then discussed. One suggestion was that the group might combine research with a field trip in a working trip to Los Alamos and/or Livermore (Sandia was also mentioned). Drawbacks here included the fact that not all members of the group had Q clearances, and many felt that there were more interesting places to visit, particularly since it is not difficult for most DSSG members to visit these institutions individually, as part of their professional lives.

Other possibilities mentioned:

- (1) Suppliers to military, such as Boeing and Lockheed.
- (2) Minuteman silos and LCCs.
- (3) NASA control centers during or after next year's shuttle launch.
- (4) The "blue cube"--ground control center for military satellites.
- (5) National Army Training Center in the Mojave Desert.
- (6) PAVE PAWS radars.
- (7) COBRA DANE and COBRA JUDY (4, 6 and 7 might possibly be combined).
- (8) White Sands.
- (9) CINCEUR, NATO headquarters.
- (10) Observe a nuclear test.
- (11) Missile launch at Vandenberg.
- (12) Antarctic research stations.

Of the above, the greatest enthusiasm was displayed towards visiting NASA during shuttle launch, seeing a nuclear test, and visiting the Army's installation in the Mojave.



The above represents a wish list and the group would like to ask Bob Roberts to investigate which might be possible. In December, the DSSG can decide, along with Bob, what final form the trip(s) might take, which would then settle the question of allocation of time between trips and research.

If the trip decided upon is only for a few days, the group might take it during the spring meeting, leaving the summer meeting or meetings for research. Otherwise, we can take our trip in one block of time over the summer and use the other block solely for research, as was done last year. In either case, two meetings as opposed to three in 1988 might increase the group's efficiency in both learning new topics and beginning an effective research program. The final format for 1988 should become much clearer at the December meeting.

### **POST-THIRD-YEAR-PLANS**

Many members of the group wish to continue to work after the program's third year. One way to do this might be for us to generate a proposal at the end of the third year. Another possibility is to stay on as IDA consultants, if possible. It was noted that \$4 million of IDA programs is geared towards infrared technology, in which many group members possess considerable expertise. It might be possible for some members to "attach" to IDA projects, if IDA itself is interested. Those wishing to expand contacts with IDA staff might discuss the matter with Bob Roberts.

On a final note, Nate Lewis is soliciting designs for the official DSSG T-shirt. Tasteful contributions only, please.

### **ADDENDUM TO MINUTES**

(1) A subcommittee composed of Steven Case, Katherine Faber, Bruce Hajek and Randy Katz suggested organizing a briefing on manufacturing to be held at the December or April DSSG meeting. The suggestion is motivated by the widespread concern about the competitiveness of U.S. manufacturing of both commercial and military goods. DARPA is receiving Congressional funds earmarked for a manufacturing initiative beginning in FY 1988. Speakers could come from:

- DARPA-ISTO (Clinton Kelly, Head of DARPA manufacturing initiative),
- A successful company in flexible manufacturing, such as Allen Bradley Co.,

- MIT Sloane School of Management, on trends in manufacturing,
- An advanced electronics manufacturer, such as Hughes Aircraft Co.

(2) If there is any general interest, Warren Warren can probably set up a field trip to a magnetic resonance imaging facility. Contact him.

## MINUTES OF DECEMBER 5, 1987 DSSG MEETING

### 1988 DSSG PROGRAM

The third year program will consist almost exclusively of intensive research. There will be no spring meeting, two summer meetings of approximately nine days duration, and a late fall wrap-up meeting. There will be one special visit of brief (2-3 days) duration to the Army National Training Center in the Mojave. It will be possible to arrange for a visit to the nuclear test site nearby, although chances of being there during an actual shot are remote. Most people were interested in viewing the facility, although this interest dampened somewhat after discussions with the mentors. Nevertheless, a visit should be arranged if judged appropriate, perhaps conditional on activities around the site at the time. (Since the meeting with the mentors, it's not clear to me whether this last sentence represents the sense of the group, but it's my best guess.) Also, many were interested in a visit to the Shuttle Command Center at some unspecified future date.

The early summer meeting will take place on the West Coast and will be organized by Randy Katz and Phil Marcus, who will choose an appropriate site in consultation with Bob Roberts. The late summer meeting will take place at IDA and is being organized by Bruce Hajek and Deborah Joseph.

### NEW MEMBERS

The mentors floated a suggestion that future membership in the DSSG be considered an award or fellowship, with accompanying public announcements (e.g., an advertisement in the *Physics Today*) to publicize the group. The suggestion was met with strong disapproval by the DSSG. The publicity issue had been discussed previously and rejected, and most felt the situation had not changed.

All felt that clarification was needed. What would be the purpose of the ad--to increase the potential pool of applicants, bring glory to new members of the DSSG, bring glory to IDA, or something else entirely? All felt that private contact was by far the best method to bring in new people and most that the group could work best without

publicity and the possible outside interference, from both friendly and hostile quarters, that might bring. It was noted that JASON doesn't advertise, publicize its mission, or even reveal its members' names. Some were worried that publicity could cause some loss of control of the program's image--if journalists become interested, they could essentially write almost anything. In addition, the ad itself couldn't possibly convey the program's image and might cause confusion. If it were only a list of names and an announcement that these people had been awarded, say, an IDA fellowship, it might drive away potential new members who are not seeking such publicity. Most felt it could only decrease the pool of potential new members.

The group's consensus at the end of the discussion was that any publicity did not serve a useful purpose to any future DSSG, and might be potentially harmful. The proposal was strongly rejected.

Russ Caflisch and Deborah Joseph will serve as liaisons to Bob Roberts and the mentors with regard to the selection of new members. It was suggested that each DSSG member submit 3-5 names to Russ or Deborah. Many have already submitted names in the past; if you feel they disappeared down the black hole of IDA bureaucracy this would be a good time to resubmit them. Once again, a need was expressed for people in fields other than the physical sciences, particularly biologists and mechanical and aeronautical engineers.

## **BRIEFINGS TO DARPA**

Some members of the group were annoyed that DARPA people did not attend the briefings at this meeting, which supposedly had been held for that very reason. The group had earlier (at the June meeting, to be precise) decided to avoid the set of formalized briefings which characterized the end of the first cycle, and were then strongly urged to present a set of at least semiformal briefings. This in turn led to the West Coast meeting and the final organization of the December meeting. It appeared, however, that DARPA people were not encouraged to attend. Some felt this was partly the fault of the DSSG, which was so unenthusiastic about presenting DARPA with formal briefings that Bob Roberts might have felt it would be wiser not to lobby strongly for their attendance. Others felt that since we had in the end prepared a set of strong presentations, DARPA should have been there, and were unhappy with the final outcome.

In light of this, all felt that it should not be necessary for any of our members to fly back to Washington and give their briefings again to DARPA. There were several

suggestions about what could be done. One was simply to bind together copies of the viewgraphs and send them to DARPA. This was vetoed since, without an accompanying talk, the viewgraphs would be contextless and therefore useless. We certainly didn't want a repeat of last year's problems.

Many felt that the presence of several mentors was sufficient in itself, in that they have strong ties to DARPA and can impart their impressions of the meeting and program to DARPA. Some of those who gave talks were willing to flesh them out in written form, if that would prove helpful. They would also be receptive to further discussions with DARPA if interest exists. This would probably not entail flying to Washington but might be done over the phone or by other means.

## **FUTURE PLANS**

Most people in the group wish to remain together as a research entity after the program's third year. At the West Coast meeting in October, discussions included both remaining affiliated with IDA or becoming independent.

It was pointed out that survival of the DSSG program itself might hinge on our remaining to serve as consultants to a new group after the third year to avoid a large turnover--one group out, another in--which would provide a natural time for funding cutoff if that were a serious possibility. We would, however, need to find a sponsor and specific tasks. It was agreed that it would be useful for us to receive regular notices of meetings of future DSSG groups from IDA so we could attend if we wished.

Two separate issues were identified: what would happen to us, and what would happen to the DSSG program or its future incarnations?

One way to look at the issue of this particular group's future is to decide how money will be generated: through IDA, other organizations of a similar nature, or privately (e.g., an independent consulting group consisting of present DSSG members)? Many preferred to remain under the auspices of IDA and take responsibility for our own funding. A problem with this is that a proposal for funding in 1990 would need to be written fairly soon, and we won't have a good idea of our own research directions until the summer meeting. This is an area where the mentors could be extremely helpful.

Some proposed the possibility of trying to get some research done before then on our own, but the hard-headed realists among us pointed out that most of us do little or no DSSG-related work between meetings. Other factors enter as well. It certainly would be

difficult to rely on only one sponsor, considering the diversity of interests and directions within the group; we may need several. We might also consider independent foundations, such as MacArthur--again, the mentors could be very helpful here.

It might be helpful to ask Bob Roberts to seek additional funding to cover our expenses in the year of overlap between us and the new group. This could also help prevent the program from fizzling entirely.

Further discussion followed concerning the nature of the future group. Most do not want to model ourselves after JASON. Some thought we might act as a sort of meta-review group for DARPA, with our interdisciplinary nature providing a strong selling point. Others felt that DARPA probably already used many strong referees in a diversity of fields.

The last proposal was that we simply continue as a research group much in our present form, with some investment of time during the year to get together and do research. We would remain under the auspices of IDA and receive independent funding from DARPA and/or other agencies. Since the purpose of the program was to introduce young academic scientists to defense issues, it seems to us worthwhile to follow up on the initial investment if those scientists now wish to use their expertise to continue thinking about such problems.

Finally, it was suggested that we and the next group should have our clearances upgraded to Top Secret to prevent us from constantly running into information barriers. However, it was pointed out that this would gain us almost nothing in the way of useful information; that would require compartmentalized clearances, which we might seek on a case-by-case, need-to-know basis.

**APPENDIX D**

**LIST OF SESSION COORDINATORS  
AND  
COMMITTEE MEMBERS**

## LIST OF COORDINATORS AND COMMITTEE MEMBERS

### A. MEETING RECORDERS

Frederick Lamb

November 1987-May 1988

Daniel Stein

June 1988-present

### B. SESSION ORGANIZERS

#### 1. Spring Technical Meeting:

Naval Operations and Capabilities:

CDR John Allison, USN  
Nancy P. Licato, IDA

Defense R&D: Budget & Policy Issues: Martha Krebs, Mentor

#### 2. Tour of Naval Operations:

CDR John Allison, USN

Nancy P. Licato, IDA

Katherine Faber, DSSG

Daniel Stein, DSSG

#### 3. Fall Working Session:

Russel Caflisch, DSSG

Nathan Lewis, DSSG

#### DSSG Topic Coordinators

Katherine Faber

High T<sub>c</sub> Superconductors

Frederick Lamb

Space Debris

Thomas Rosenbaum

Anti-Terrorism

Warren S. Warren

Surface Ship Torpedo Defense

W. Stanley Williams

Submarine Laser Communications



#### **4. Review Session**

Steven Koonin, DSSG

Warren S. Warren, DSSG

##### **DSSG Briefers**

Philip Marcus

Overview of FY 87 Program

Thomas Rosenbaum

DSSG Study Program Long Range Effects

Frederick Lamb

Monitoring Yields of Underground Nuclear Tests

Nathan Lewis

IR Detector Technology

W. Hugh Woodin

Mechanical Applications of High Temperature  
Superconductors

R. Stanley Williams

Blue-Green Laser Communications

#### **5. Search Committee**

Richard Bernstein, Mentor

Russel Caflisch, DSSG

Deborah Joseph, DSSG

**APPENDIX E**

**TASK STATEMENT**



# DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

1400 WILSON BOULEVARD  
ARLINGTON VIRGINIA 22209

## ASSIGNMENT FOR WORK TO BE PERFORMED BY INSTITUTE FOR DEFENSE ANALYSES

PROJECT ASSIGNMENT NO. A-103

DATE: SEP 6 1985

You are hereby requested to undertake the following task:

1. TITLE: Young Scientists Program
2. BACKGROUND: In order to solve the technical problems crucial to the defense of the United States, it is imperative that the country's best scientists and engineers become involved in defense issues. In recent years there has not been the high level of interaction between these scientists and the Department of Defense as was enjoyed in the past. There is currently a need for greater support from the scientific community, and in particular its younger members, on defense-related scientific and technical problems. The purpose of this task is to create an analysis program which brings together the brightest young scientists and engineers to work on current defense problems, and in the process to educate them to the nature and specifics of those problems.
3. TECHNICAL SCOPE: IDA shall seek out the best young scientists and engineers in the country and bring them together to discuss current problems in science and technology, which are of interest to the Department of Defense. This would be a select group of 10 to 40 scientists, who are recognized worldwide as being the new leaders in emerging areas of research. The scientists will be introduced to the technical problems of interest to DoD and will use their unique abilities to provide possible solutions to these problems.

In particular, IDA will:

1. be responsible, in coordination with the sponsor, for definition of the problems;
2. conduct the selection process for the scientists;
3. act as the liaison between DARPA and the young scientists;
4. interact with and provide information for the young scientists; and
5. organize a final briefing for the sponsor in which the findings of the group are presented.

**APPENDIX F**

**PROGRAM ADMINISTRATION**

## ADMINISTRATION

A stipend of \$10,000 per year will be provided, for which the participant will be expected to attend all meetings and summer sessions. In addition, travel and expenses will generally be fully reimbursed.

Participants will be required to obtain a Secret security clearance in order to participate in the Program. IDA will assist in this process, but cannot guarantee clearance. Independent research projects need not be classified, however.

IDA, in administering the Program, will make every effort to keep paperwork to a minimum and to respond to the needs of the participants in a direct and, wherever possible, informal fashion. IDA will be responsible for technical help ranging from providing computing time to arranging to bring participants together with experts in areas of interest.